15.247(e) Processing Gain Requirement

1. Theoretical Processing Gain Calculation

The theoretical processing gain of the 12bit spreading BPSK system is calculated as follows;

Processing Gain = 10Log(Spreaded data rate / Unspreaded data rate)

= 10Log[(12 Chip/bit x 100Kbit/sec) / (100Kbit/sec)]

= 10Log(12)

= 10.8 dB

2. Measurement of the Processing Gain

Following method is specified to measure processing gain by FCC. The detailed are in FCC Public Notice FCC97-114. This involves transmitting a CW jammer in the RF passband of the system and measuring the jammer to signal ratio (Mj) required to achieve a certain bit error rate. The jammer stepped in 50 kHz increments across the entire passband and in each case the Mj to achieve the desired bit error rate is measured. The Mj is measured at the RF input to the system under test. The lowest 20 percents of the Mj data (in dB) are discarded. The processing gain can then be calculated as follows:

$$Gp = (S/N)o + Mj + Lsys$$

Where, Gp is the processing gain, the (S/N)o is that theoretically predicted for the system under the test to achieve the desired bit error rate, the Mj is the lowest value (in dB) in the remaining data set and Lsys adjusts for non-ideal system loss. Lsys can not be greater than 2 dB.

When the reference bit error rate for DBPSK is specified as 10^(-3), the corresponding (S/N)o is 8.0 dB. The system loss Lsys is maximum 2 dB. Therefore, the processing gain Gp is expressed as follows;

$$Gp = 8\ (dB) + Mj + 2\ (dB) = Mj + 10\ (dB)$$

3. Processing Gain Measurement Test Set-up

The test set-up is shown in Fig.1. The facsimile equipment and cordless handset are configured to measure the Bit Error Rate (BER) through signal translation adapters and serial ports of a personal computer. A software utility program (FCCVP4105.exe by Conexant) is used to configure the test mode, establish the link between the facsimile equipment and cordless handset, and monitor the results. The BER test is displayed on the monitor. The strength of the received signal entering at the receiving antenna port of the unit under test is derived from the signal strength of the transmitting unit. The jammer signal, which is generated by an SG, is combined with the signal from the facsimile equipment in a combiner and is output to the RF input of the cordless handset.

4. Measurement Procedure

Setup the measurement configuration as shown in Fig.1. Where, Fig.1 shows the measurement setup for the cordless handset.

1. Set the RF input signal of EUT (handset in Fig.1) at a signal level, **S** in dBm.
2. Increase the jammer signal level at EUT while monitoring BER such that the BER is equal to the reference BER, 10^(-3). This jammer signal level at EUT is recorded as Jamming signal level, **J** in dBm.
3. Increment the jammer signal frequency in steps f 50kHz and repeat step 2.
4. The jammer to signal ratio, Mj are calculated as (**J** – **S**) in dB.
5. The processing gain, Gp are calculated as (Mj + 10) in dB.
6. Discard 20 percents of worst Gp data and determine the lowest processing gain, Gp in remaining 80 percent Gp data.

5. Results

Facsimile equipment: Gp = 15.4 dB

Cordless handset: Gp = 13.85 dB

This system meets the FCC requirement of the processing gain.

Result : **PASS**

Test Result of Processing Gain

Model : UX-CL220 (Facsimile)　　Ｔｅｓｔ CH：２１

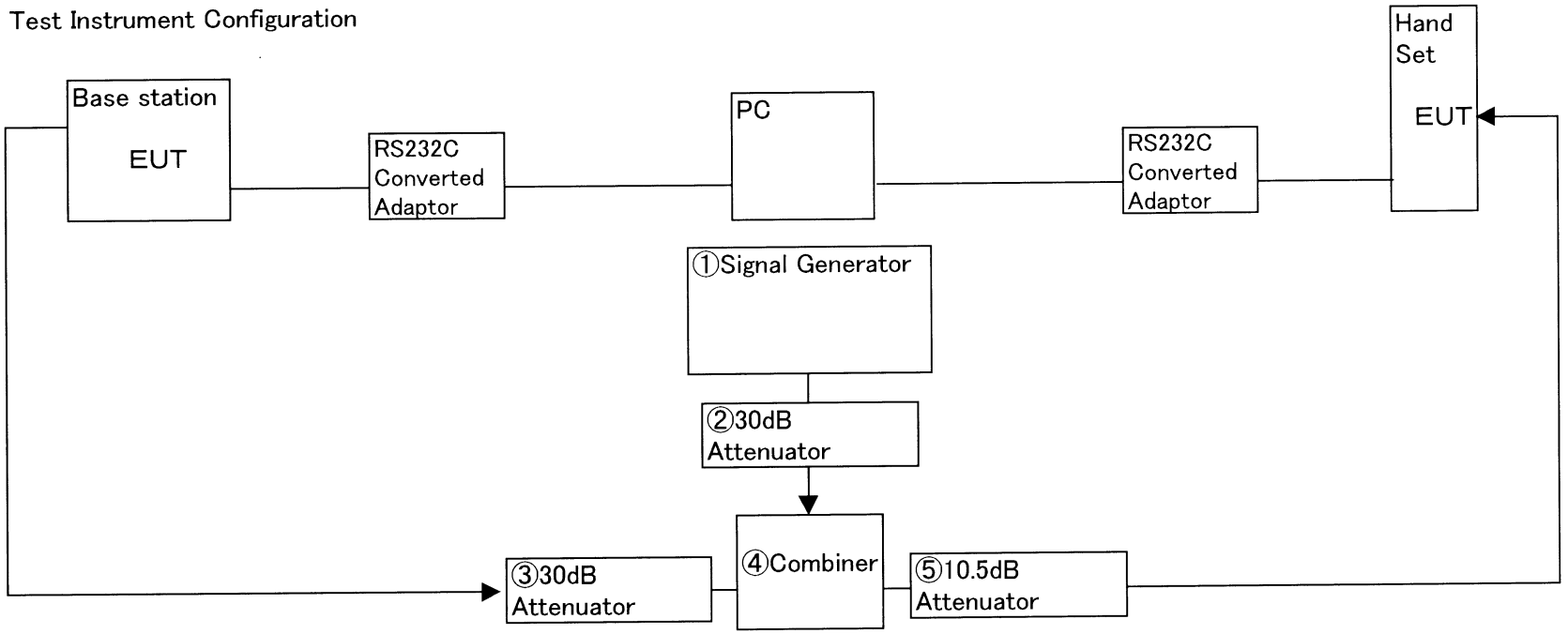
Jammer F	Signal Level	SG Level	Mj(J/S)	Process Gain
2439.800	-54.70	-32.1	22.60	32.60
2439.850	-54.70	-37.9	16.80	26.80
2439.900	-54.70	-40.7	14.00	24.00
2439.950	-54.70	-44.1	10.60	20.60
2440.000	-54.70	-46.3	8.40	18.40
2440.050	-54.70	-46.2	8.50	18.50
2440.100	-54.70	-46.0	8.70	18.70
2440.150	-54.70	-46.0	8.70	18.70
2440.200	-54.70	-46.8	7.90	17.90
2440.250	-54.70	-47.4	7.30	17.30
2440.300	-54.70	-49.4	5.30	15.30
2440.350	-54.70	-49.4	5.30	15.30
2440.400	-54.70	-50.5	4.20	14.20
2440.450	-54.70	-50.6	4.10	14.10
2440.500	-54.70	-51.2	3.50	13.50
2440.550	-54.70	-47.3	7.40	17.40
2440.600	-54.70	-46.7	8.00	18.00
2440.650	-54.70	-46.2	8.50	18.50
2440.700	-54.70	-47.7	7.00	17.00
2440.750	-54.70	-46.7	8.00	18.00
2440.800	-54.70	-39.1	15.60	25.60
2440.850	-54.70	-38.9	15.80	25.80
2440.900	-54.70	-46.6	8.10	18.10
2440.950	-54.70	-46.7	8.00	18.00
2441.000	-54.70	-47.6	7.10	17.10
2441.050	-54.70	-47.8	6.90	16.90
2441.100	-54.70	-50.6	4.10	14.10
2441.150	-54.70	-48.8	5.90	15.90
2441.200	-54.70	-49.3	5.40	15.40
2441.250	-54.70	-50.1	4.60	14.60
2441.300	-54.70	-50.5	4.20	14.20
2441.350	-54.70	-47.4	7.30	17.30
2441.400	-54.70	-46.1	8.60	18.60
2441.450	-54.70	-45.7	9.00	19.00
2441.500	-54.70	-45.2	9.50	19.50
2441.550	-54.70	-43.9	10.80	20.80
2441.600	-54.70	-42.4	12.30	22.30
2441.650	-54.70	-30.7	24.00	34.00
2441.700	-54.70	-30.9	23.80	33.80
2441.750	-54.70	-46.5	8.20	18.20
2441.800	-54.70	-25.1	29.60	39.60
unit	dBm	dBm	dB	

Test Result of Processing Gain

Model : UX-CL220K (Cordless Handset)　　ＴｅｓｔCH：２１

Jammer F	Signal Level	SG Level	Mj(J/S)	Process Gain
2439.800	-52.35	-31.6	20.75	30.75
2439.850	-52.35	-34.2	18.15	28.15
2439.900	-52.35	-40.4	11.95	21.95
2439.950	-52.35	-40.3	12.05	22.05
2440.000	-52.35	-41.9	10.45	20.45
2440.050	-52.35	-44.3	8.05	18.05
2440.100	-52.35	-45.1	7.25	17.25
2440.150	-52.35	-45.3	7.05	17.05
2440.200	-52.35	-45.2	7.15	17.15
2440.250	-52.35	-45.6	6.75	16.75
2440.300	-52.35	-47.5	4.85	14.85
2440.350	-52.35	-47.5	4.85	14.85
2440.400	-52.35	-48.5	3.85	13.85
2440.450	-52.35	-48.7	3.65	13.65
2440.500	-52.35	-48.9	3.45	13.45
2440.550	-52.35	-49.0	3.35	13.35
2440.600	-52.35	-49.0	3.35	13.35
2440.650	-52.35	-47.2	5.15	15.15
2440.700	-52.35	-47.6	4.75	14.75
2440.750	-52.35	-47.5	4.85	14.85
2440.800	-52.35	-45.4	6.95	16.95
2440.850	-52.35	-45.3	7.05	17.05
2440.900	-52.35	-46.0	6.35	16.35
2440.950	-52.35	-47.6	4.75	14.75
2441.000	-52.35	-47.6	4.75	14.75
2441.050	-52.35	-46.6	5.75	15.75
2441.100	-52.35	-48.8	3.55	13.55
2441.150	-52.35	-48.8	3.55	13.55
2441.200	-52.35	-48.5	3.85	13.85
2441.250	-52.35	-48.2	4.15	14.15
2441.300	-52.35	-49.5	2.85	12.85
2441.350	-52.35	-47.7	4.65	14.65
2441.400	-52.35	-46.7	5.65	15.65
2441.450	-52.35	-45.9	6.45	16.45
2441.500	-52.35	-44.5	7.85	17.85
2441.550	-52.35	-44.9	7.45	17.45
2441.600	-52.35	-44.6	7.75	17.75
2441.650	-52.35	-44.4	7.95	17.95
2441.700	-52.35	-40.7	11.65	21.65
2441.750	-52.35	-41.4	10.95	20.95
2441.800	-52.35	-36.2	16.15	26.15
unit	dBm	dBm	dB	

Test Instrument Configuration



Test Equipment

NO	Instrument	Model no.	Maker
①	Signal Generator	MG3672A	Anritu
②	30dB Attenuator	MP721E	Anritu
③	30dB Attenuator	MP721E	Anritu
④	Combiner	MP520D	Anritu
⑤	10.5dB Attenuator	MP659A	Anritu

FIG. 1